PATENT

REINFORCED SILT RETENTION SHEET

CROSS-REFERENCE TO RELATED APPLICATIONS

This application claims priority to United States Provisional Application Serial No. 60/406,176, filed August 27, 2002, which is incorporated by reference herein in its entirety.

TECHNICAL FIELD

The present invention is directed to materials used in water runoff management and erosion control and, more specifically, to reinforced silt retention fabric materials.

BACKGROUND

When geotextile fabric is used in erosion control and water runoff management, the fabric commonly is attached with fasteners to wooden or metal stakes driven into the ground to secure the fabric in position to collect and filter dirt and debris from runoff water flows. The fasteners used typically include staples, hooks, rings or similar devices that are inserted through the fabric to attach it to the stakes. Due to its relatively thin, porous nature, however, the geotextile fabrics usually do not exhibit enough tensile strength to avoid pulling and tearing at the insertion or puncture points of the fasteners as water, direct and debris bear against the

fabric as runoff flow passes therethrough. When the fabric pulls and tears, it frequently fails to control erosion effectively. Consequently, there is a need for geotextile fabrics and sheets that resist tearing and pulling at fastener insertion points.

SUMMARY

Briefly described, the present invention generally is directed to a silt retention sheet or silt screen material having a body or web that generally is formed of woven or non-woven filter material, such as a spun bond polypropylene, polyester or similar flexible polymeric material that allows water to pass therethrough, but substantially prevents silt and debris from passing therethrough. The silt retention sheet further includes one or more reinforcing elements, strips, or belts attached to the web at spaced intervals along or across the width of the web. Fasteners are inserted or applied through the water-permeable web of filter material at selected locations along the reinforcing strips to attach the web material to stakes or support members.

The reinforcing elements prevent ripping and tearing of the filter material at the points where the fasteners are inserted through or attached to the filter material, and further provide areas for supporting the engagement and hold of the fasteners to the filter material against heavy water flows or the accumulation of sediment and debris against the web. Some examples of the reinforcing material include woven strips of nylon, reinforcing strands of fiberglass and other rugged polymeric materials. The reinforcing elements can be applied as strands, cords, arrays, strips, patches or lengths of material attached along the web of the silt screen material by stitching, adhesion, felting, impregnation, heat fusion, weaving or similar means. For example,

in one embodiment, the reinforced silt retention sheet includes a plurality of woven nylon strips or patches sewn onto and extending along the length of the web of filter material, with the strips spaced across the width of the web.

In another embodiment, the silt retention sheet includes a first water-permeable web on which is layered a second water-permeable web, with a reinforcing element disposed between portions of the first and second webs. The webs may be formed of woven and/or non-woven materials and constructed so as to allow water to pass therethrough while tending to prevent the passage of silt and/or debris therethrough. The reinforcing element can include a plurality of reinforcing strands or strips that form a band. A series of reinforcing bands can be formed so as to define a reinforcing structure or array extending along selected portions of the web.

These and other aspects of the present invention are described in greater detail below and shown in the accompanying drawings that are briefly described as follows.

BRIEF DESCRIPTION OF DRAWINGS

Fig. 1 is a side elevational view of a portion of a silt retention sheet encompassing principles of the present invention.

Fig. 2 is a side elevational view of a portion of the silt retention sheet of Fig. 1 fastened to support members.

Fig. 3 is a side elevational view of a portion of an additional embodiment of a silt retention sheet encompassing principles of the present invention.

Fig. 4. is a side elevational view of a portion of yet another embodiment of a silt retention sheet encompassing principles of the present invention.

Fig. 5 is a side elevational view of a portion of still another embodiment of a silt retention sheet encompassing principles of the present invention.

Fig. 6 is a side elevational view of a portion of another alternative embodiment of a silt retention sheet encompassing principles of the present invention.

Fig. 7 is a side view of a portion of a further alternative embodiment of a silt retention sheet encompassing principles of the present invention.

DETAILED DESCRIPTION

As shown in Figs. 1-7, wherein like numerals refer to like parts throughout the several figures, various embodiments of reinforced silt retention sheets according to the present invention generally are disclosed for use in soil erosion control applications. The reinforced silt retention sheets generally include one or more webs or sheets of a substantially water-permeable material to which one or more reinforcing elements are attached and serve as points of attachment for fasteners that are used to fasten the reinforced silt retention sheets to support members to anchor the sheets in position to filter silt and debris from water passing through the sheet in soil erosion control applications. The reinforcing elements further help to reduce the incidence of tearing, pulling and separation of the water-permeable web material at or around the points of attachment for the fasteners.

As used herein, the term "water-permeable" generally refers to the ability of an element or article to allow water to pass or flow therethrough. The flow rate of water through a "water-permeable" structure as used in the present invention generally will be sufficient for soil erosion control applications in which storm water runoff must be filtered and allowed to pass through the structure without substantial pooling or flooding around the silt retention sheet(s) when installed.

In Fig. 1, the reinforced silt retention sheet 10 generally includes a sheet, blanket or web 12 formed from a geotextile fabric or other, similar water-permeable filter material to which reinforcement elements or belts 20 are attached in spaced series. The water-permeable web of filter material 12 can be formed from woven or non-woven natural or polymeric materials, such as spun bond polypropylene, spun bond polyester, woven polypropylene, nylon, various woven or spun synthetic and/or natural fibers. The silt retention sheet 10 typically is of a width of about 1-4 feet, though greater or lesser widths can be used depending upon the application or use, and generally will be unrolled or fed out and cut to a desired length.

The reinforcement elements 20 generally are formed of a strong, resilient and substantially tear resistant material, such as woven nylon or other polymeric materials, such as spun or woven yarns, cord materials, fiberglass, aramid fibers or other, similar high strength, flexible materials, and are applied to the water-permeable web 12, such as with lines of stitching 24. The reinforcement elements 20 may also be attached to the water-permeable web 12 by any other appropriate means, such as adhesives, hook-and-loop fasteners, staples etc. Furthermore, the reinforcement elements 20 can be integrally formed with the water-permeable web, such as by weaving or other non-

woven fabrication processes by which the reinforced elements are infused or woven into the body of the web. The reinforcement belts support and provide reinforcement points at which fasteners can be attached to the web 12 for securing the web to stakes or other supports. As shown in Fig. 1, the reinforced silt retention sheet 10 also includes a reinforcement border 22 attached to the edge of the water-permeable web 12. The reinforcement border 22 further helps to strengthen the water-permeable web 12 and provide an additional area for attaching fasteners thereto.

Fig. 2 shows the reinforced silt retention sheet 10 of Fig. 1 fastened to ground supports, such as stakes 50, by fasteners 60. The stakes 50 typically will be wooden or metal stakes or can be formed of any other resilient, durable materials to support the web. The fasteners 60 can include staples, pins, nails, rings, clips, or any other suitable fastener for securing the web to the stakes, depending on the type of stakes used. The fasteners 60 are fastened to the stakes 50 and inserted through the reinforcement elements 20 and the reinforcement border 22 to retain the sheet 10 in place. In this manner, the sheet 10 may be securely positioned at desired locations for filtering runoff waterflows passing through the water-permeable web 12 while preventing the passage of silt or debris therethrough. The reinforcement elements help support the web on the stakes 50 by providing enhanced strength at the points of engagement of the fasteners 60 with the web to resist tearing of the web as silt and dirt build up thereagainst.

Fig. 3 shows an alternative embodiment of a reinforced silt retention sheet 110 according to the present invention. In this embodiment, the reinforcement elements 120 generally comprise patches or strips distributed or applied at selected locations

across the sheet of the water-permeable material or web 112. The reinforcement elements 120 may be attached to the water-permeable web 112 as discussed above with regard to attachment of the reinforcement elements 20 to web 12. As discussed above, the water-permeable web 112 shown in the Figures may be any suitable material used to retain silt and debris while allowing passage of water therethrough. The reinforcement elements 120 may be distributed along the sheet 110 in any appropriate or desired number or pattern to provide multiple spaced areas of reinforcement and/or attachment. The web is attached via fasteners applied through the reinforcement elements to attach the web to supports such as stakes and prevent or resist tearing or pulling of the web away from the supports as water passes therethrough.

Fig. 4 discloses another embodiment of the reinforced silt retention sheet of the present invention. In this embodiment, the silt retention sheet 210 is formed of a non-woven, water-permeable web 212 composed of a suitable polymeric material. Reinforcing elements 220 are attached at spaced locations across the width of the web 212 by appropriate means, such as stitching, adhesion, felting, stapling, riveting, etc. The reinforcing elements 220 in this embodiment generally are bands that extend longitudinally along portions of the web 212 to provide points of attachment of fasteners to the sheet 210. The bands may be formed of various materials, such as woven polymeric belts, plastic strips, twisted or spun yarns, cord, ropes, spun fibers such as fiberglass, or other suitable structures. The reinforcing bands 220 enable attachment of the web 212 to ground supports with various desired spacings between the supports as needed.

Fig. 5 shows yet another embodiment of a reinforced silt retention sheet 310. As with the silt retention sheet 210 shown in Fig. 4, the silt retention sheet 310 generally includes a water-permeable, woven or non-woven filtering material body or web 312 to which a series of reinforcing elements 320 are attached. The reinforcing elements 320 generally are composed of a plurality of reinforcing strips or strands 322 that are aligned in proximity with each other to form bands extending along the web 312. The reinforcing strands 322 are formed of fiberglass or polymeric materials, such as polypropylene, polyester or nylon, and can be either monofilaments or yarns. As shown in Fig. 5, the reinforcing strands 322 are aligned in proximity to each other but do not intertwine or overlap. The reinforcing strands 322 can be attached by a variety of means to the web 312, including threading or weaving the strands through the web, felting, heat fusion or simply can be disposed within the web 312 during manufacture of the web. The proximity of the reinforcing strands 322 to each other to form the reinforcing elements 320 tends to increase the strength of the sheet 310 in and around the reinforcing elements 320, even though the reinforcing strands do not intertwine or overlap. Nonetheless, the reinforcing strands 320 impart sufficient strength to the silt retention sheet 310 to reduce the incidents of tearing, separation and pulling of the web 312 when the sheet 310 is fastened to support members by fasteners attached to the sheet 310 at the reinforcing elements 320 as discussed above with reference to the sheet 10 of Figs. 1 and 2.

Fig. 6 shows a further alternative silt retention sheet 410 of the present invention in which an array 424 of reinforcing strands 422 is provided. As shown in Fig. 6, the reinforcing strands of the array 424 intersect and overlap each other across

at least a portion of the silt retention sheet 410. The array 424 further typically can include one or more bands 421 of reinforcing materials that make up the reinforcing elements 420. The bands 421 generally are composed of two or more reinforcing strands 422 that are aligned adjacent to each other in closer proximity than the other strands within the array 424. The reinforcing strands of the bands 421 generally are aligned parallel to each other and may contact or overlap each other to form the bands 421. In this embodiment, the reinforcing elements 420 constitute areas along the sheet 410 that have higher concentrations of reinforcing strands 422 than the average concentration of strands on the sheet 410. The array 424 of reinforcing strands generally strengthens the web 412 to which it is attached. As shown in Fig. 6, the web 412 is composed of a non-woven material, such as spun bond polypropylene or polyester. The reinforcing strands of the reinforcing elements 420 and the array 424 may be attached to the web 412 by various means, such as adhesion, heat fusion, impregnation, weaving, stitching, felting, etc.

Fig. 7 shows a further alternative embodiment of the reinforced silt retention sheet 510, which includes a first water-permeable non-woven web 512a on which is layered on a second water-permeable non-woven web 512b. An array 524 of reinforcing strands is disposed between the first and second webs 512a and 512b and includes one or more bands 521 formed of reinforcing strands that constitute reinforcing elements 520 of the sheet 510. Although the webs 512a and 512b shown in Fig. 7 generally are non-woven, the present invention encompasses silt retention sheets that include woven webs that are layered on each other to form the sheet of the present invention. For example, the reinforced silt retention sheet of the present

invention may include one or more non-woven water preamble webs layered on one or more woven water-permeable webs that tend to prevent the passage of silt and debris therethrough. The webs may be layered upon each other by various means, such as adhesion, interweaving, stitching, felting, heat fusion, etc. As used herein, the term "layered on" refers to the orientation of one article or element relative to another and generally means that at least a portion of one element is applied to another element in an overlapping and parallel relationship. Although Fig. 7 discloses an array 524 of reinforced strands that form in part the reinforcing elements 520 of the sheet 510, it is to be understood that other reinforcing elements in combinations thereof shown in the various embodiments may be incorporated into a sheet in which two or more webs are layered on each other.

It should be understood by those of skill in the art that the certain modifications may be made to the disclosed embodiments without departing from the scope of the present invention.